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(54) LASER WELDING METHOD

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(56)References Cited

U.S. PATENT DOCUMENTS

4,015,100	A	3/1977	Gnanamuthu et al.
2003/0150842	A1	8/2003	Mikame
2005/0028897	A1	2/2005	Kurz et al.
2013/0168371	A1	7/2013	Furusako et al.
2014/0377578	A1*	12/2014	Hisada B23K 26/22
			428/594
2015/0104243	A1*	4/2015	Watanabe B23K 11/11
			403/271
2015/0174702	A1*	6/2015	Fujimoto B23K 11/115
			428/594

FOREIGN PATENT DOCUMENTS

EP	2 628 563 A1	8/2013
JP	H091341 A	1/1997
JP	2001-062575 A	3/2001
JP	2007-253179 A	10/2007
JP	2013-132686 A	7/2013
KR	1020130052013 A	5/2013
	(Cont	inued)

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(57)ABSTRACT

A laser welding method includes: projecting a laser beam onto irradiation regions on plural metallic workpieces such that a weld section is formed when the workpieces are joined by laser welding, the weld section being formed of plural nuggets, and each of the irradiation regions being formed with each of the nuggets. The nuggets are sequentially formed by sequentially projecting the laser beam onto the irradiation regions that respectively correspond to the nuggets. The laser beam is projected onto each of the irradiation regions such that an amount of input heat from the laser beam that is projected onto each of the irradiation regions to the workpiece is reduced as the nuggets are sequentially formed.

4 Claims, 10 Drawing Sheets

